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Abstract

A METHOD FOR THE CALCULATION OF THREE-DIMENSIONAL FLUX AND TEMPERATURE DISTRIBUTIONS IN A MAGNOX REACTOR

COMPARISON WITH EXPERIMENTAL MEASUREMENTS TAKEN AT THE LATINA POWER STATION

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For control purposes, it is essential to have a full knowledge of core temperature distribution in a power reactor, under any operating conditions.

It is also essential, for economic purposes, to predict perturbation to a certain temperature distribution, likely to be caused by absorbers re-patterning required by long-term reactivity change, in order to keep the optimum channel rating distribution.

The required information cannot be provided experimentally, since, for practical limitations, the installed thermocouples are only a few of the total number which would be required. Therefore a reliable method of predicting rating and temperature distributions has to be developed.

This is a three-dimensional problem, since the presence of discontinuous absorbers and control rods, partially inserted in the core, causes radial, azimuthal and axial distortions to the neutron flux distribution.

The three-dimensional multiradial, multiaxial codes at present available cannot be applied to the gas-cooled reactors, on account of their large dimensions.

The authors tackled the problem by developing a calculation method which is an appropriate combination of 2 two-dimensional IBM-704 computer codes, the FTD-2 and the PDQ, both of which assume a constant flux shape in the third dimension.

In order to override the intrinsic limitation of these two codes, the authors used the PDQ code to obtain radial variation of a few parameters related to the axial flux shapes at a given height.

This information, properly handled and fed into the FTD-2 code, makes possible for the code to supply x, y flux distribution at a given height, as well as the outlet gas temperatures and the three-dimensional can temperature distribution.

This method of predicting flux and temperature distributions on a three-dimensional basis was checked against experimental results obtained from Latina nuclear power station during commissioning and operation: a satisfactory agreement was obtained.

Furthermore, a proposal is made for using this method for assessing the operation of magnox gas-cooled reactors by means of gas and can temperature analysis.